

REMARKS

In the Office Action, the Examiner rejected Claims 1 and 4-7 under 35 U.S.C. 103 as being unpatentable over the prior art discussed in paragraphs 14-17 of the present application in view of U.S. Patent 6,022,791. (Cook, et al.)

Applicants wish to note that a Supplemental Amendment, adding new Claims 16 and 17 was filed on April 15, 2005. Because the April 11, 2005 Office Action was not a final Action, It is believed that entry of the April 15, 2005 Amendment is appropriate, and that Claims 16 and 17 are presently in the application.

This opportunity is being taken to amend Claim 1 to better define the subject matter of the claim, and more specifically, to describe in more detail the relationship between the water seal and the crack stop. New Claim 18, which is dependent on Claim 17, is being added to also describe this relationship in more detail.

For the reasons set forth below, Claims 1, 4-7 and 16-18 patentably distinguish over the prior art and are allowable. The Examiner is thus asked to reconsider and to withdraw the rejection of Claims 1 and 4-7, and to allow these claims and the above-mentioned Claims 16-18.

The present invention, generally, relates to a crack stop for low k dielectric materials of an integrated circuit. As explained in the present application, during an IC dicing operation, cracks can form that can propagate into the active area of the IC chip, causing fails. In the prior art, crack stop layers have been incorporated into the perimeter of the IC chip to prevent cracks formed during chip dicing from propagating into the chip.

For example, Figure 1 of the present application shows a metal crack stop that extends around a moisture barrier region. While the crack stop may prevent propagation of the cracks, those cracks expose the copper in the metal stack to water vapor, causing oxidation of the copper. This then causes exposure of the copper in the moisture barrier, which allows moisture to enter the chip, and this can lead to chip failure.

The present invention effectively addresses this problem; and, more specifically, the invention effectively addresses the problem caused by cracks when a metal stack moisture barrier/edge seal is formed in the chip. In accordance with this invention, this is done by forming the crack stop as at least one trench or void between the moisture barrier/edge seal and the outer periphery of the IC chip, and extending the trench or void crack stop substantially completely between a bottom substrate and a top aluminum layer of the IC chip.

The prior art discussed in the present application does not use such a crack stop. Instead that prior art uses a metal stack crack stop.

Cook, et al. discloses, in Figure 3d, a crack stop formed by a trench 46. The portion of Cook, et al. that discusses Figure 3d, though, does not address the specific problem of preventing crack stops when a metal stack moisture barrier/edge seal is used in the IC chip. Accordingly, Cook, et al. does not suggest any specific solution for that problem.

The present invention does address this specific problem. And this is done, not simply by using a deep trench, but, in addition, by locating the deep trench in a specific position – outside of the metal stack moisture barrier/seal and between that barrier/seal and the outer periphery of the IC chip. This specific position – and the relationship between the moisture barrier seal and the crack stop of this invention – are not taught or suggested by Cook, et al.

Independent Claims 1 and 7, as amended herein, describe the above-discussed feature of the present invention. In particular, these claims describe the feature that the trench, void or groove of the crack stop is outside of the moisture barrier/edge seal and between that barrier/edge seal and an outside periphery of the IC chip, and that this trench or void extends substantially completely between the bottom substrate and the top aluminum layer of the IC chip. As mentioned above, this feature is important because it helps to prevent the migration of the cracks to the metal stop water seal. This feature thus prevents the cracks from leading to oxidation of the water seal – a problem that is not addressed by the device shown in Figure 3d of Cook, et al.

Because of the above-discussed differences between Claims 1 and 7 and the prior art, and because of the advantages associated with those differences, Claims 1 and 7 patentably distinguish over the prior art. Claims 4-6 are dependent from Claim 1 and are allowable therewith. The Examiner is, thus, asked to reconsider and to withdraw the rejection of Claims 1 and 4-7 under 35 U.S.C. 103, and to allow these claims.

Claim 16 is an independent claim of intermediate scope, and it is submitted that this claim describes a number of features not shown in or suggested by the prior art. In particular, the prior art does not disclose or suggest the manner in which the water seal/edge barrier and crack stop function together for preventing damage to the active area of the integrated circuit. It is noted that none of Claims 16 and 17 has been rejected, and these claims, and new Claim 18, also patentably distinguish over the prior art and are allowable.

In light of the above-discussion, the Examiner is asked to enter to reconsider and to withdraw the rejection of Claims 1 and 4-7 under 35 U.S.C. 103, and to allow these claims and Claims 16-18. If the Examiner believes that a telephone conference with Applicants' Attorneys would be advantageous to the disposition of this case, the Examiner is requested to telephone the undersigned.

Respectfully submitted,

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